



**HOLLOMAN AFB
NEW MEXICO**

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 559



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 833D COMBAT SUPPORT GROUP (TAC)
HOLLOMAN AIR FORCE BASE NM 88330 5000

REPLY TO 833 CSG/DEV
ATTN OF

07 JUN 1991

SUBJECT RCRA Post Closure Care Permit Application

TO New Mexico Environment Department
Kathleen Sisneros, Director
Water and Waste Division
1190 St Francis Drive
Santa Fe, NM 87503

1. Attached please find our application for a Post Closure Care Permit, including our request for delay-of-closure of the Holloman AFB surface impoundments.
2. Should you have questions regarding the application or require additional information, please contact Sharon Moore at 479-3931.


IRA L. HESTER, Colonel, USAF
Commander

Atch
Post Closure Care Permit
Application

cc: See Distribution List

w/out atch

LAGOONS/FEDERAL FACILITIES COMPLIANCE AGREEMENT
Distribution List

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REPORT TO EPA
REGARDING
HOLLOMAN AIR FORCE BASE
LAGOONS
AND
T-38 WASHRACK OIL-WATER
SEPARATOR
HOLLOMAN AFB, NEW MEXICO
22 DECEMBER 1983

1. Oil-Water Separator

a. Description of the Source of the Waste. This oil-water separator is located at the 479th Tactical Training Wing (TTW) Corrosion Control Facility near Building 306. Wastes to this separator are presently from two sources, and until June 1983, there was also a third source.

(1) Source No. 1: Aircraft Washing Operations. Aircraft washing operations do not generate hazardous waste. The wastes consist of water, aircraft soap, and PD-680 (Type II). On the average, approximately seven aircraft per week are washed. The amount of water used is approximately 2,000 gallons during an average 45 minute wash of an aircraft, and the amount of PD-680 used is approximately three gallons. PD-680, Type II, is a petroleum distillate having a flash point of 140 degrees F. Some of the PD-680 and water evaporate during use; the remainder, along with the soap, falls on the concrete pad from which the liquid flows to a paint-chip collection box, and then to the oil-water separator. A lift station removes the aqueous phase from the separator and discharges it to the sanitary sewer system and thence to the Holloman sewage lagoons.

(2) Source No. 2: Parts Stripping Operations. Parts stripping operations also do not generate hazardous waste. Large parts, such as ladders, are stripped of their paint. Approximately five parts per month are stripped, using approximately 20 gallons of paint stripper per month. The stripper, along with a water rinse, are discharged to the separator by the same route as described in "Source No. 1" above. The paint stripper used is B&B Paint Stripper No. 4411 (NSN 8010-P-4411), B&B Chemical Co., Miami, Florida. The stripper was analyzed in 1982 by the USAF Occupational and Environmental Health Laboratory (OEHL) and found to consist of methylene chloride, ammonium hydroxide, aromatic sulfonate, and furfuryl alcohol. While methylene chloride is a listed hazardous waste, ammonium hydroxide and furfuryl alcohol are not, and according to the Corrosion Control Management Office at Robbins AFB, ammonium hydroxide and furfuryl alcohol are both active ingredients as well as the methylene chloride. Therefore, the stripper is not a hazardous waste because the methylene chloride is not the sole active ingredient, according to 40CFR 261.33, and because it does not possess the characteristics in 40CFR261 subpart C.

(3) Source No. 3: Corrosion Control Treatment of Aircraft. The aircraft corrosion control operation using chromium was halted in June 1983 (with the exception of an experimental test in November 1983—see below), pending determination of the hazardous nature of the waste stream. The wastes consisted of water, paint stripper, soap, and phosphoric-acid based waste, chromium trioxide, and calcium sulfate. The wastes followed the same route to the lagoons as described in "Source No. 1" above. Approximately one aircraft per week was treated from December 1980 until October 1982, and three aircraft were treated from October 1982 until operations were suspended. It is anticipated that if operations are resumed, one aircraft per month would be treated (one aircraft per week were treated during 1980-1982 in order to meet contract requirements for treating the entire fleet). The following is a detailed description of the operations:

(a) Step No. 1: The aircraft is initially washed with approximately three gallons of PD-680 (Type II) as described in "Source No 1" above.

(b) Step No. 2: The paint is stripped from the aircraft with approximately 100 gallons of B&B Paint Stripper No. 4411 (described in "Source No. 2" above).

(c) Step No. 3: The aircraft is washed with soap and water and rinsed with water.

(d) Step No. 4: The aluminum panels are pre-treated with three to six gallons of a phosphoric-acid based solution (MIL-C-38334). Deoxidine 605 (Turco Products, Inc) is the solution generally used, consisting of: 5% phosphoric acid, 5% nitric acid, 3% fluoroboric acid, and 87% nonhazardous ingredients. The aircraft is then rinsed liberally with water.

(e) Step No. 5: The aluminum panels are then treated with a chromic acid solution. Allodyne 1201 (Anchem Products) is the solution generally used, consisting of an aqueous solution of 1% chromic acid, 0.6% potassium ferricyanide, and 0.1% hydrofluoric acid. Three gallons of this solution are used, and the aircraft is then rinsed with water.

(f) Step No. 6: The magnesium panels are pre-treated with two or three applications of three gallons of chromic trioxide (CrO_3) solution (1.33 oz. CrO_3 per gallon), and the aircraft is then rinsed with water.

(g) Step No. 7: The magnesium panels are treated with a three gallon solution containing 4 oz. of CrO_3 and 3 oz. of calcium sulfate, and the aircraft is then rinsed with water.

b. Description of Sampling and Analytical Protocol Used to Test the Waste, the Procedures Used, and a Show of Representativeness of the Samples to the Waste Stream, Including Paint Chips. Results of sampling of the waste at the oil water separator depend on the amount of time since corrosion control operations have occurred. Some samples of the aqueous phase taken while corrosion treatment was occurring were hazardous. Sludge samples taken in 1982 (i.e., during the period when the corrosion treatment was still operating) were hazardous. On the other hand, samples of the sludge and the aqueous phase taken in October 1983, some four months after corrosion treatment was stopped, were nonhazardous.

The samples taken in October 1983 were taken following the procedures in EPA's SW-846a (Aug 8, 1980), "Test Methods for Evaluating Solid Waste—Physical Chemical Methods." The sludge samples were taken from the main compartment (east side and west side) and from the oil compartment and sewer manhole downstream. The samples were collected using a glass container attached to a ten foot steel rod. The glass container was lowered into the sludge and dragged several times across the bottom of the cell. Each sludge sample was deposited in a plastic container and mixed to obtain a composite sample for each cell. The composited sludge was then transferred to a glass container. The wastewater samples were also collected using a glass container. The wastewater was collected from at least one foot beneath the oil surface and transferred to a glass container. After each wastewater and sludge sample was

collected, the collection container was washed with tap water. The samples were analyzed for chromium by the USAF Occupational and Environmental Health Laboratory (OEHL), utilizing a procedure to simulate leaching from a waste by rainfall through a landfill (EP Toxicity Test), in accordance with the procedures in 40CFR 261, Appendix II. None of these October 1983 samples was hazardous. The water samples ranged from 0.53 to 0.78 mg/l chromium. The sludge samples had 0.38 mg/l in the main compartment, and 0.90 mg/l in the oil compartment, and 1.67 mg/l in the sewer manhole downstream.

It is suspected that the paint chip analyses also depend on time since chromium treatment. Paint chips taken while chromium treatment was occurring in 1982 were hazardous. Recently, the chips have been resampled and Holloman will submit results to EPA once obtained.

c. Description of the Function of the Oil-Water Separator and how the Oil-Water Separator Meets the Requirements for Exemption Under 40CFR 261.6(a). At a meeting 16-17 November 1983 between EPA Region VI and Air Force representatives, EPA contacted the RCRA hotline and determined that the separator may be subject to reduced hazardous waste requirements pursuant to 40CFR 261.6(a). Under this special provision, the separator would not be subject to 40CFR 262 through 265 nor to 270, 271, and 124, provided that Holloman beneficially uses or reuses or legitimately recycles or reclaims the oil from the separator, according to EPA's determination at the 16-17 November meeting. Holloman has started and will continue a program for recovery of the oil for beneficial use or reuse, thus allowing the waste aqueous phase, when and if hazardous, to be subject to this special provision.

The oil water separator is an oil recovery device which skims oil from the top of the oil-water system as it flows through the separator. The oil is periodically removed from the oil compartment and sent to the Defense Property Disposal Office (DPDO), along with other sources of waste oil on base, for sale to Mesa Oil Inc., 4701 Broadway S.E., Albuquerque, N.M. 87105. Mesa Oil passes the oil through an oil-water separator to remove any water, and the oil is sold for its energy value as a burner fuel in industrial applications.

While the percent of oil recovered from the Holloman 479TTW corrosion control oil-water separator cannot be stated at this time, since records of oil recovery from separators are not presently required, Holloman has begun to keep such records to substantiate that a significant portion of the oil is being recovered. A small amount of data has been generated since the separator was last emptied on 21 September 1983; however, the period of record is so short that an accurate reflection of percent recovery has not yet been determined, since estimates presently show that 210 gallons of petroleum have been used while 410 gallons have been recovered. Data submission to EPA from this separator will be augmented as it becomes available.

d. Description of How the Operational Changes in the Paint Stripping Area Will Result in Chrome Levels Never Exceeding the EP Toxicity Limit (5 mg/l). Two aircraft were treated in early November 1983 using substantially less chromium than in the past, and analysis results showed that chromium exiting the separator was barely above the 5 mg/l concentration limit. This procedure entailed only a single application of the chromic trioxide solution described in "Step No. 6" above, and involved drumming any leftover solutions, for disposal to DPDO, rather than sewerage them as in the past. While it remains

to be seen if an acceptable corrosion coating was obtained, it is anticipated that this procedure will be acceptable.

Using these modified procedures in November 1983 resulted in four out of nineteen samples exiting the separator exceeding 5 mg/l total chromium, with the highest being 7 mg/l. Further changes are being contemplated which could... reduce the chromium generation such that the chrome levels will not exceed the EP toxicity limit. The current method is to apply the chromium by dipping a scotch pad into a bucket containing the chemicals and then transferring the material to the aircraft; this results in a substantial loss of chemicals to the pad. Modification of this step to apply the chemical solutions directly to the aircraft, such as with a spray applicator, would greatly reduce the loss of chemicals to the drain. It would be expected that utilization of this procedure, if found to produce an acceptable corrosion coating, would result in chrome levels that do not exceed the EP toxicity limit.

e. Description of the Operation and Maintenance of the Separator to Show that Oil Recovery is Ensured and that Chrome Levels are Maintained at or Below those Found in the Sampling Program. To ensure that the separator is operating as an oil recovery device for beneficial use or reuse of oil, Holloman has started a program to inspect and maintain the separator and to keep records on its operation. Inspection consists of a weekly inspection of both the main compartment and the oil compartment by the 479TTW Corrosion Control personnel. If the oil level in the oil compartment nears the level of the oil inlet opening, the oil will be immediately removed and sent to DPDO. In addition, the 479TTW personnel will keep records of the amounts of PD-680 used and the dates, and the amounts of oil recovered and the dates. The records will be forwarded to the Base Environmental Coordinator, and if it is determined that at least 85% oil recovery is not being attained, the separator will be evaluated for operational problems and the problems found will be corrected.

To ensure that chrome levels are maintained at or below those found in the sampling program, two procedures will be followed. First, procedures for generating the chrome will not differ from that in the sampling program, with the exception that such procedures may be modified to produce less, but not more, chromium. Second, the sludge from the bottom of the separator will be removed when the depth of the sludge is not greater than 15% of the depth of the liquid plus sludge (15% is approximately nine inches of sludge); removal will be accomplished by an on-call contractor. This latter procedure will ensure that precipitated chromium will not be carried over into the wastewater stream.

2. Surface Impoundments

a. Description of the Waste, both Liquid and Sludge Portions. The waste entering the surface impoundments (lagoons) consists of 1-2 million gallons per day of domestic and industrial wastewater from Holloman Air Force Base. The domestic wastewater arises from family housing and industrial facilities on base; the industrial wastewater arises from such sources as aircraft washing facilities, paint stripping and corrosion facilities, hospital and industrial analytical laboratories, machine shops and maintenance shops.

There are presently five active lagoons encompassing approximately 87 acres at an estimated average depth of four feet, resulting in a volume of approximately 110 million gallons. At least some of the lagoons have been active since the 1940s. Sludge is formed at the bottom of the ponds and consists of an estimated one-half to one foot thick semi-liquid slurry.

b. A List and Quantification of the Hazardous Constituents of the Waste. The following description of the hazardous constituents of the waste is based on two sources. The first source consists of the sampling and analysis studies which have been performed at the lagoons, the second source consists of information on the substances which have entered the wastewater.

The first source, the sampling and analysis studies, have not indicated that the waste entering, within, or leaving the lagoons possesses hazardous characteristics. Three studies have been performed. The first study (Attachment 1), was an extensive sampling and analysis program by USAF Holloman. Wastewater entering the lagoons and leaving the final lagoon, and sludge from the lagoons were analyzed by the EP toxicity procedure for contaminants characterizing EP toxicity in 40CFR 261.24, and it was found that none of the samples exceeded the maximum concentration limit allowed in that regulation.

Two later, less extensive studies also by USAF Hospital Holloman have been performed on the lagoons because of concern about chromium from corrosion control operations, and neither of these have resulted in samples from the lagoons showing hazardous characteristics. In the first, samples of discharge from the final lagoon in 1983 were analyzed and found to contain no levels above the detectable limit (0.05 mg/l). In the second, samples of sludge from the first two lagoons (A and B) in October 1983 showed no sample concentrations being greater than 0.05 mg/l as determined by the EP Toxicity Test.

The second method of describing the constituents of the waste is composed of a description of the waste substances entering the wastewater stream. The primary constituents of the wastewater stream are nonhazardous, consisting of domestic wastewater and of industrial wastewater from such sources as aircraft washing. The remaining constituents have been in minor quantities by comparison.

Since the lagoons have been in existence since the 1940s, it is not possible to describe with certainty the hazardous constituents and their quantities which entered the wastewater prior to the hazardous waste regulations in 1980, however, the sampling and analysis studies described above indicate that if such constituents did enter the wastewater, the waste in the lagoons nevertheless does not display the characteristics of EP toxicity (and ignitability, corrosivity, and reactivity would be out of the question), possibly as a result of dilution and dispersion of any such constituents.

From December 1980 to June 1983, chromium described in detail in the "Oil-Water Separator" report above entered the wastewater stream, however, by the time the wastewater entered the lagoons, it no longer displayed the characteristics of hazardous waste listed in 40CFR 261 Subpart C, most likely because of dilution by other sources of wastewater to the lagoons. No pure wastes listed in 40CFR 261 Subpart D have, to the best of our knowledge, been discharged to the lagoons; while such wastes have been discharged to the lagoons in diluted form as a mixture with the domestic and industrial wastewater to the lagoons, the quantities of such wastes have, however, been small in relation to the 1-2 million gallons per day of the wastewater. These Subpart D wastes, to the best of our knowledge, consist of listed spend solvents from 40CFR 261.31.

c. A Discussion of the Effects of Dilution and Accumulation of Constituents by Precipitation (pH/chrome Relationship in Impoundments). A discussion of the effects of dilution is presented in paragraph b above.

With regard to accumulation of constituents by precipitation (pH/chrome relationship in impoundments), Captain Forrest Sprester of USAF Holloman has been performing research in this area for three years, and the following is a summary of his analysis.

At least four factors prevent buildup of chrome in the sludge, despite the fact that under laboratory conditions, precipitation might be expected to occur. First, dissolved oxygen (D.O.) causes oxidation of chromium to its most soluble form; second, oxides in the soil and water also cause such oxidation to occur; third, organic ligands in the waste water facilitate the oxidation; and fourth, once solubilized, the chromium is dispersed widely and does not reach concentration levels high enough to precipitate. Experimental results in two areas provide evidence to substantiate this prediction: first, at industrial facilities discharging high concentrations of chromium, and second, at Holloman AFB sewage lagoons.

Under laboratory conditions, chromium would be expected to precipitate at the pH and sulfide levels normally found in the Holloman AFB sewage lagoons. Chromium has several valences of which the most prevalent is the trivalent, and the most soluble is the hexavalent. The hexavalent is soluble at all pH's, whereas the trivalent precipitates above pH7. Sulfides normally present in sewage cause reduction of the chromium to the trivalent form, and at pH's greater than 7, which are the pH's normally present in Holloman's lagoons, precipitation would thus be expected to occur.

However, there are at least four reasons why this does not in fact occur. First, high D.O. levels will oxidize the trivalent back to the soluble hexavalent form. Holloman's lagoons are aerated, and experience, particularly in the summer months, supersaturated dissolved oxygen conditions. Lake Holloman was monitored in June 1979 and had a D.O. concentration of 14 mg/l, compared to a saturation level of 8 mg/l. Second, oxides such as calcium oxide and magnesium oxide have, in the presence of oxygen in the soil been shown to cause oxidation of the trivalent form to the hexavalent. Calcium oxide and magnesium oxide are common in highly alkaline soils such as those in and around Holloman AFB, and occur to some extent in the water also due to contact with the soil. These substances would then be expected to augment the effect of D.O. in oxidizing the trivalent to the soluble hexavalent. Third, organic

complexing agents present in the wastewater facilitate the process. If trivalent chromium is in solution and complexed organically, it is more readily converted to the hexavalent form. Organic complexing agents which may be present to some extent in the Holloman sewage consist of diethylenetriaminepentaacetic acid (DTPA), which results from the base photo laboratory's use of this chemical in developing film, and citric and fulvic acids, which are breakdown products of sewage. Fourth, since chromium is predominantly in the oxidized, hexavalent state as a result of these processes, and since hexavalent chromium is soluble, it is dispersed widely throughout the system and does not reach concentration levels high enough to precipitate. There are 270 acres of surface water available into which the chrome may be distributed, including all the sewage ponds and Lake Holloman, and in addition it may be dispersed into the surrounding soil and groundwater.

These considerations are consistent with two experimental observations. First, discharges at industrial facilities (not Holloman) of large concentrations of chromium into unlined lagoons have not shown buildup in the sludge to hazardous level. For example, industry has used hexavalent chromium in cooling towers as a corrosion inhibitor and algicide for over half a century at concentrations of up to 50 mg/l. Evaluation of these waste ponds sludges using a total extraction method, i.e., the sludge was digested with strong acid to a pH < 1, has found only small amounts of total chromium but not exceeding 5 mg/l, the RCRA standard for chromium. Ground water sampling around these same waste ponds resulted in chrome concentrations being detected at concentrations much higher than the original background concentration.

Second, analysis of sludge samples in Lagoons A and B at Holloman AFB have not shown detectable levels of chromium by the EP Toxicity Test, substantiating that precipitation of chromium to hazardous levels is not occurring. Samples taken on 5 November 1981 showed less than 0.2 mg/l chromium and samples taken on 21 October 1983 showed less than 0.05 mg/l chromium.

Bibliography for Response to Paragraph c

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Bartlett, R.J., "Chromium." Sludge Guidelines for the Northeast. Regional Publication, Vermont (1983).

Bartlett, R.J., and B.P. James, "Behaviour of Chromium in Soils". J. Environmental Quality. Madison, Wisc. (1983), Parts 1 - 6.

Bartlett, R.J., "Oxidation/Reduction Status of Aerobic Soils". Chemistry in the Soil Environment. Madison, Wisc: American Society of Agronomy (1981).

Texas Department of Water Resources. TDWR Newsletter. Austin, TX (May, 1983).

d. The Sampling Protocol, Including a Discussion on Representativeness, Sampling Procedures, and Equipment. In the 1982 study, samples were collected in mid-November 1981, as described on pages 7-9 of that paper (Attachment 1). The following additional information is provided regarding these procedures.

Representativeness of the samples was accomplished by following the procedures in EPA's SW846-a (Aug 8, 1980), "Test Methods for Evaluating Solid Waste - Physical Chemical Methods", Section 3. The wastewater samples entering the lagoons were representative of a day on which corrosion control operations were occurring, since corrosion control personnel stated that chromium treatment of an aircraft was occurring on the day of the sampling (for the samples of water leaving the lagoons and for the sludge samples, however, this would not be an important factor).

Further details on the sludge sampling procedures, in addition to the above information on representativeness and the information in Attachment 1, is as follows. Each evaporation pond was sectioned into four areas as shown in Figure 1. Sludge samples were obtained for each pond by dragging an Eckman Bottom Dredge, FSN 6640L001968, behind a small, flat bottomed boat and combining the sludge amassed in each section into a five gallon bucket which was stirred to thoroughly mix. The bucket was dropped while the boat was moving. Each section was transversed twice, as shown in the figure, by completing a circle twice. There were approximately 15-40 samples collected per transverse. The Eckman Bottom Dredge is a 6" x 6" x 6" square design weighing ten pounds and is designed to sink into the sludge for much or all of its height.

With respect to chromium, a hazardous constituent which has been of primary concern at Holloman, the above sampling procedures would be expected to recover sludge samples which contain any precipitated chromium not only for the above reasons, but also because it would be expected that any precipitated chromium would be found near the sediment-water interface than in underlying sediments, as studies on the distribution of trace elements in Lake Michigan have shown. (1)

Like the samples taken for the 1982 study, the representativeness of the samples taken in the October 1983 study was also accomplished by following the procedures in SW846-a (Aug 8, 1980). (2) The following additional information is provided on these October 1983 samples to help further establish that vertical representativeness (although apparently not horizontal representativeness) was accomplished for this later less extensive study. A glass jar was fixed to the end of a ten-foot long pole, and the jar was lowered to the sludge with the mouth of the jar turned down. As the jar entered the sludge, the jar was forced downward and along the bottom to collect the sludge. This technique was used over an area 10 to 20 feet from the influent point. Approximately 10 samples were collected in a glass jar and composited.

e. A Mass-Balance for Chrome to Show that Chromium is not Accumulating in the Lagoons. A mass balance of chromium entering the lagoons indicates that levels of chromium in solution would theoretically not accumulate to a level

(1) Samuel D. Faust, Chemistry of Natural Waters (1981), p 385.

(2) By the time this 1983 study was performed, SW846 had since been revised (July 1982), however, the revised edition was not used.

above the EPA-designated 5 mg/l concentration limit until the 25th century, based on anticipated generation rates and using a conservative assumption that all chromium remains in the lagoons and in solution. In addition, the instantaneous concentrations discharged to the lagoons would be lower than the hazardous concentration limit by a wide margin. The following discussion provides the basis for these assertions.

Flow of domestic and industrial wastewater to the lagoons in the late 1970s was on the order of one million gallons per day (MGD); however, flows have apparently increased in recent years to approximately 1.8 MGD. The active lagoons encompass a total of 87 areas, excluding Lake Holloman, and, at an approximate average depth of four feet, hold more than one hundred million gallons of wastewater.

Corrosion control operations at the 479th Tactical Training Wing (TTW) are the only present and anticipated significant source of chromium to the lagoons. Discharge to the lagoons from this operation began in December 1980. This date is used as a baseline for the mass balance, since samples taken in approximately that time period (November 1981) indicated undetectable levels of chromium in the effluent from the last lagoon and in the sludges in the lagoons.

The volume of water in the active lagoons is approximately:

$$86.5 \text{ acres} \times 43,500 \frac{\text{ft}^2}{\text{acre}} \times 4 \text{ ft deep}^{(1)} \times 28.3 \frac{\text{liters}}{\text{ft}^3} = 4.26 \times 10^8 \text{ liters.}$$

The maximum concentration of chromium above which the lagoons would contain hazardous levels, based on 40 CFR 261.24 is 5 mg/l, which means that the lagoons could contain a maximum of:

$$\frac{5 \text{ mg}}{\text{liter}} \times 4.26 \times 10^8 \text{ liters} \times \frac{1 \text{ lb}}{4.54 \times 10^5 \text{ mg}} = 4700 \text{ lb. of chromium.}$$

The amount of chromium generated in the treatment of an aircraft is as follows: (see report on the oil-water separator for a description of the steps).

(1) Steps 1-3 (Washing and Stripping): No significant levels of chromium are generated by Steps 1-3.

(2) Step 4 (Pretreatment of Aluminum Panels): The Deoxidine solution does not contain chromium, so no significant levels of chromium are generated by Step 4.

(3) Step 5 (Allodyne Treatment of Aluminum): The Allodyne 1201 solution is 1% CrO_3 ⁽²⁾ and 2.875 gallons are used; however, two applications

(1) 21 Nov 83 information from treatment plant operator.

(2) 22 Nov 83 telephone conversation with Amchem Products, Ambler, PA.

may be needed. Therefore, the amount of chromium generated from Step 5 is:

$$2 \text{ applications} \times 2.875 \text{ gal} \times 8.34 \frac{\text{lb}}{\text{gal}} \times \frac{1 \text{ lb CrO}_3}{100 \text{ lb solution}}$$

$$\times \frac{52 \text{ lb chromium}}{100 \text{ lb. CrO}_3} = 0.25 \text{ lb.}$$

(4) Step 6 (Corrosion removal from magnesium surfaces): The strength of this solution is 1-1/3 oz. CrO₃ per gallon. Two or three (assume three) applications of three gallons each may be required for complete corrosion removal. Therefore, the amount of chromium from Step 6 is:

$$3 \text{ applications} \times 3 \text{ gal} \times \frac{1.33 \text{ oz. CrO}_3}{\text{gal}} \times \frac{1 \text{ lb.}}{16 \text{ oz}} \times \frac{52 \text{ lb chromium}}{100 \text{ lb CrO}_3}$$

$$= 0.39 \text{ lb.}$$

(5) Step 7 (Treatment of Magnesium Panels): Four ounces (0.25 lb.) of CrO₃ are used in this step, and so the amount of chromium generated from Step 7 is:

$$0.25 \text{ lb} \times \frac{52 \text{ lb chromium}}{100 \text{ lb CrO}_3} = 0.13 \text{ lb.}$$

The total amount chromium generated per aircraft is the sum of these seven steps, which is:

$$0.39 + 0.25 + 0.13 = 0.77 \text{ lb/aircraft.}$$

Assuming all chromium generated remains in the lagoons, the total number of aircraft that could be treated is therefore:

$$\frac{4700 \text{ lb}}{0.77 \text{ lb/aircraft}} = 6103 \text{ aircraft}$$

before the 5 mg/l limit would be exceeded.

A 22 November 83 interview with the 479th corrosion control personnel revealed that they expect to treat twelve aircraft per year, and that approximately 60 aircraft have been treated since December 1980.⁽¹⁾ At this rate of treatment, hazardous levels of chromium would not be reached in the lagoons until the year:

$$1984 + \frac{6103 \text{ aircraft} - 60 \text{ aircraft already treated}}{12 \text{ aircraft per year}} = 2488 \text{ A.D.,}$$

assuming operations are allowed to resume in 1984. This shows that it would take considerable time for hazardous concentrations to form in the lagoons, and, in fact, the concentration may never reach this level because advancing

(1) The reason that there was a higher rate of aircraft treatment in the past than is anticipated for the future is that until Oct 82, approximately one aircraft per week had to be treated in order to meet contract requirements for treating the entire fleet.

technology may well negate the need for metallic aircraft, which require chromium treatment. More advanced aircraft are constructed of composite materials.

A final consideration is whether the instantaneous levels of chromium discharged to the lagoons represent hazardous levels. The process of treatment of an aircraft takes approximately two hours, during which the above 0.77 lb. of chromium would be generated. During this two hour period, the concentration of chromium discharged to the lagoons is estimated to be:

$$\frac{0.77 \text{ lb} \times 4.54 \times 10^5 \frac{\text{mg}}{\text{lb}}}{1.8 \times 10^6 \frac{\text{gal}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times 2 \text{ hr} \times 3.79 \frac{\text{liters}}{\text{gal}}} = 0.6 \text{ mg/liter}$$

which is less than the EPA limit of 5 mg/liter by a wide margin. This 0.6 mg/liter is reasonably consistent with the observed maximum value of 0.4 mg/liter on 5 November 1981 (Attachment 1, page 12).

- SAMPLING POINTS FOR SLUDGE AND WASTEWATER**
- 1 SEWAGE PLANT EFFLUENT AT COLLECTION BOX
 - 2 POND "A" (SLUDGE)
 - 3 POND "B" (SLUDGE)
 - 4 POND "C" (SLUDGE)
 - 5 POND "D" (SLUDGE)
 - 6 POND "E" (SLUDGE)
 - 7 POND "F" EFFLUENT IN DITCH LINE
 - 8 LAKE HOLLOWAY (SLUDGE)

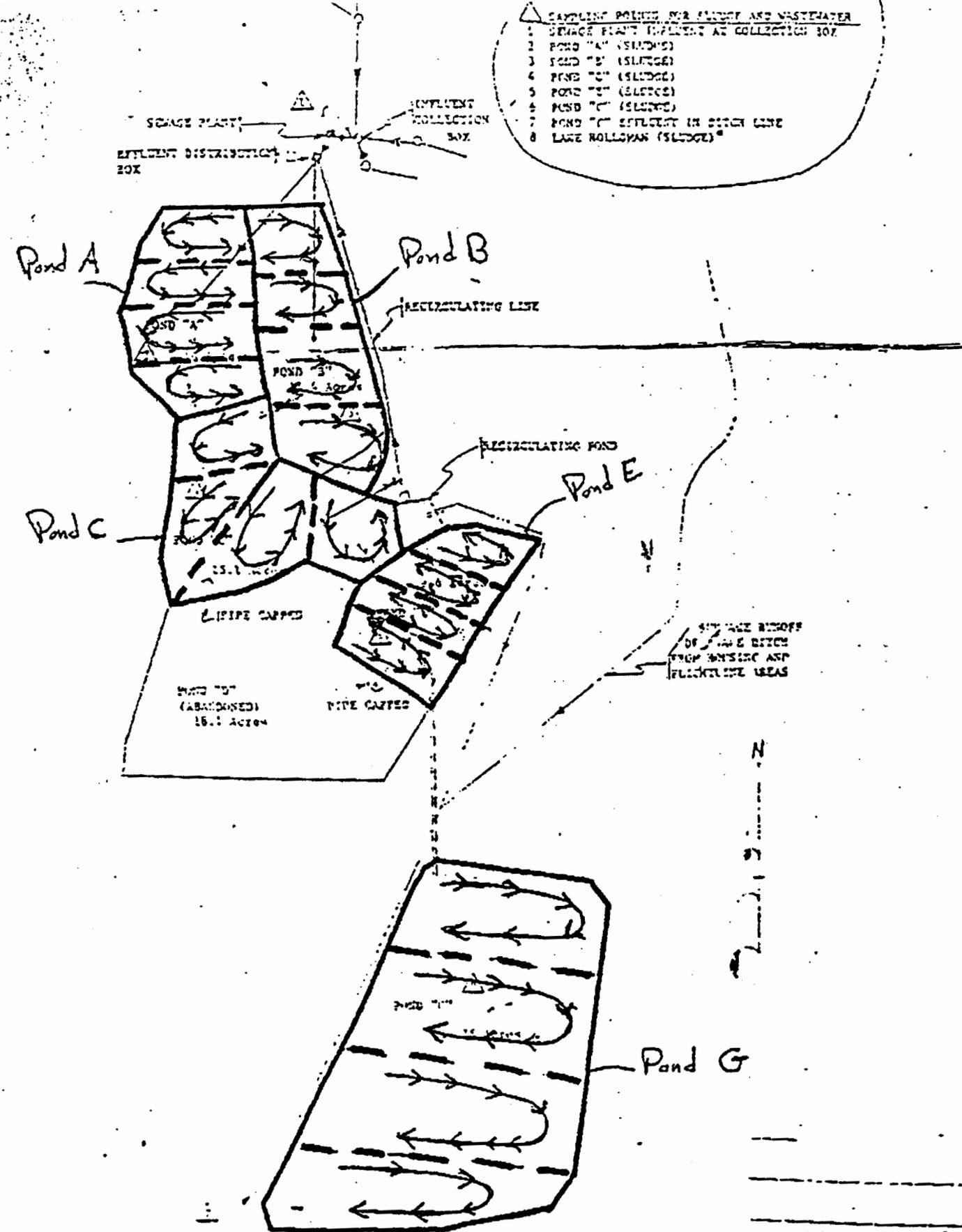


Figure 1

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ADMINISTRATIVE RECORD

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